



atdma-Configuring A-TDMA Modulation Profiles

This document describes the A-TDMA Service feature, which provides support for DOCSIS 2.0 Advanced Time Division Multiple Access (A-TDMA) upstream modulation profiles on the Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, and Cisco uBR-MC5X20S/U Broadband Processing Engine (BPE) cable interface line cards. This feature supplements the existing support for DOCSIS 1.0 and DOCSIS 1.1 Time Division Multiple Access (TDMA) modulation profiles.

Feature Specifications for A-TDMA Service

Feature History

Release	Modification
Release 12.2(15)CX	This feature was introduced for the Cisco uBR-MC28U/X cable interface line cards on the Cisco uBR7246VXR router.
Release 12.2(15)BC2	This feature was supported on the Cisco uBR-MC16U/X cable interface line cards on the Cisco uBR7246VXR router, and on the Cisco uBR-MC5X20S/U cable interface line cards on the Cisco uBR10012 router.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.



Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

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Prerequisites for A-TDMA Service

The A-TDMA Service feature has the following prerequisites:

- The following platforms, cable interface cards, and Cisco IOS software releases are needed:
 - A Cisco uBR7246VXR router must be running Cisco IOS Release 12.2(15)CX or later release to support this feature on the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X cards.
 - A Cisco uBR10012 router must be running Cisco IOS Release 12.2(15)BC2 or later release to support this feature on the Cisco uBR-MC5X20S/U cards.
- The cable physical plant must be capable of supporting the higher-bandwidth DOCSIS 2.0 A-TDMA modulation profiles.
- Cable modems must be DOCSIS-compliant. If cable modems go offline, or appear to be online but do not pass traffic when in the mixed TDMA/A-TDMA mode, upgrade the modem software to a DOCSIS-compliant version.
- The following are required to support the DOCSIS 2.0 A-TDMA features:
 - Cable modems must be DOCSIS 2.0 capable.
 - The DOCSIS configuration file for a DOCSIS 2.0 cable modem must either omit the DOCSIS 2.0 Enable field (TLV 39), or it must set TLV 39 to 1 (enable). If you set TLV 39 to 0 (disable), a DOCSIS 2.0 CM uses the TDMA mode.
 - The upstream must be configured for either A-TDMA-only or mixed TDMA/A-TDMA mode. To use the 6.4 MHz channel width, the upstream must be configured for A-TDMA-only mode.

Restrictions for A-TDMA Service

The A-TDMA Service feature has the following restrictions and limitations:

- Does not support virtual channels, as described in DOCSIS 2.0 specification.
- Does not support Synchronous Code Division Multiple Access (S-CDMA) channels.
- Cisco IOS Release 12.2(15)CX, Release 12.2(15)BC2 and later releases support a maximum of 10 modulation profiles for each of the three DOCSIS modes (DOCSIS 1.x TDMA, mixed, and DOCSIS 2.0 A-TDMA), for a total maximum of 30 modulation profiles.

- Changing the DOCSIS mode of an upstream takes all cable modems on that upstream offline, which forces the cable modems to reregister, so that the CMTS can determine the capabilities of the cable modems on the new channels.

Information About A-TDMA Service

This section describes the A-TDMA Service feature:

- [Feature Overview, page 3](#)
- [Benefits, page 5](#)

Feature Overview

The A-TDMA Service feature improves the maximum upstream bandwidth on existing DOCSIS 1.0 and DOCSIS 1.1 cable networks by providing a number of advanced PHY capabilities that have been specified by the new DOCSIS 2.0 specifications. In Cisco IOS Release 12.2(15)BC2, the A-TDMA Service feature is supported on the Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, and Cisco uBR-MC5X20S/U Broadband Processing Engine (BPE) cable interface line cards.

The A-TDMA Service feature incorporates the following advantages and improvements of DOCSIS 2.0 networks:

- Builds on existing DOCSIS cable networks by providing full compatibility with existing DOCSIS 1.0 and DOCSIS 1.1 cable modems. (The registration response (REG-RSP) message contains the DOCSIS version number to identify each cable modem's capabilities.)
- Upstreams can be configured for three different modes to support different mixes of cable modems:
 - An upstream can be configured for TDMA mode to support only DOCSIS 1.0 and DOCSIS 1.1 cable modems.
 - An upstream can be configured for A-TDMA mode to support only DOCSIS 2.0 cable modems.
 - An upstream can be configured for a mixed, TDMA/A-TDMA mode, to support both DOCSIS 1.0/DOCSIS 1.1 and DOCSIS 2.0 cable modems on the same upstream.

**Note**

DOCSIS 2.0 A-TDMA cable modems will not register on a TDMA upstream if an A-TDMA or mixed upstream exists in the same MAC domain, unless the CMTS explicitly switches the cable modem to another upstream using an Upstream Channel Change (UCC) message. DOCSIS 1.0 and DOCSIS 1.1 cable modems cannot register on an A-TDMA-only upstream.

- A-TDMA mode defines new interval usage codes (IUC) of A-TDMA short data grants, long data grants, and Unsolicited Grant Service (UGS) grants (IUC 9, 10, and 11) to supplement the existing DOCSIS 1.1 IUC types.
- Increases the maximum channel capacity for A-TDMA upstreams to 30 Mbps per 6 MHz channel.
- A-TDMA and mixed modes of operation provide higher bandwidth on the upstream using new 32-QAM and 64-QAM modulation profiles, while retaining support for existing 16-QAM and QPSK modulation profiles. In addition, an 8-QAM modulation profile is supported.
- Supports a minislot size of 1 tick for A-TDMA operations.
- Increases channel widths to 6.4 MHz (5.12 Msymbol rate) for A-TDMA operations.

- A-TDMA and mixed modes of operation provide a more robust operating environment with increased protection against ingress noise and other signal impairments, using a number of new features:
 - Uses a symbol (T)-spaced adaptive equalizer structure to increase the equalizer tap size to 24 taps, compared to 8 taps in DOCSIS 1.x mode. This allows operation in the presence of more severe multipath and microreflections, and can accommodate operation near band edges where group delay could be a problem.
 - Supports new QPSK0 and QPSK1 preambles, which provide improved burst acquisition by performing simultaneous acquisition of carrier and timing lock, power estimates, equalizer training, and constellation phase lock. This allows shorter preambles, reducing implementation loss.
 - Increases the forward error correction (FEC) T-byte size to 16 bytes per Reed Solomon block (T=16) with programmable interleaving.

**Note**

Cisco IOS Release 12.2(15)BC2 does not support the Synchronous Code Division Multiple Access (S-CDMA) modulation technique that is also specified in the DOCSIS 2.0 specification.

To simplify the administration of A-TDMA and mixed TDMA/A-TDMA modulation profiles, the A-TDMA Service feature provides a number of preconfigured modulation profiles. Each mode of operation also defines a default modulation profile that is automatically used when a profile is not specifically assigned to an upstream.

When using Cisco IOS Release 12.2(15)BC2, the Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, and Cisco uBR-MC5X20S/U cards support all DOCSIS 1.1-specified and all DOCSIS 2.0-specified A-TDMA radio frequency (RF) data rates, channel widths, and modulation schemes. [Table 1](#) shows the maximum supported DOCSIS 1.1 data rates, and [Table 2](#) shows the maximum supported DOCSIS 2.0 (A-TDMA-mode) data rates.

Table 1 Maximum DOCSIS 1.1 Data Rates

Upstream Channel Width	Modulation Scheme	Baud Rate Sym/sec	Maximum Raw Bit Rate Mbit/sec
3.2 MHz	16-QAM	2.56 M	10.24
	QPSK		5.12
1.6 MHz	16-QAM	1.28 M	5.12
	QPSK		2.56
800 kHz	16-QAM	640 K	2.56
	QPSK		1.28
400 kHz	16-QAM	320 K	1.28
	QPSK		0.64
200 kHz	16-QAM	160 K	0.64
	QPSK		0.32

Table 2 Maximum DOCSIS 2.0 (A-TDMA-mode) Data Rates

Upstream Channel Width	Modulation Scheme	Baud Rate Sym/sec	Maximum Raw Bit Rate Mbit/sec
6.4 MHz	64-QAM	5.12 M	30.96
	32-QAM		25.80
	16-QAM		20.64
	8-QAM		15.48
	QPSK		10.30
3.2 MHz	64-QAM	2.56 M	15.48
	32-QAM		12.90
	16-QAM		10.30
	8-QAM		7.68
	QPSK		5.12
1.6 MHz	64-QAM	1.28 M	7.68
	32-QAM		6.45
	16-QAM		5.12
	8-QAM		3.84
	QPSK		2.56
800 kHz	64-QAM	640 K	3.84
	32-QAM		3.20
	16-QAM		2.56
	8-QAM		1.92
	QPSK		1.28
400 kHz	64-QAM	320 K	1.92
	32-QAM		1.60
	16-QAM		1.28
	8-QAM		0.96
	QPSK		0.64
200 kHz	64-QAM	160 K	0.96
	32-QAM		0.80
	16-QAM		0.64
	8-QAM		0.48
	QPSK		0.32

Benefits

The A-TDMA Service feature provides the following benefits to cable service providers and their partners and customers:

- Full compatibility with DOCSIS 1.0 and DOCSIS 1.1 cable modems (CMs) and cable modem termination systems (CMTSs).
- Additional channel capacity in the form of more digital bits of throughput capacity in the upstream path.
- Increased protection against electronic impairments that occur in cable systems, allowing for a more robust operating environment.

How to Configure the A-TDMA Service Feature

This section describes the following tasks that are required to implement the A-TDMA Service feature:

- [Creating a TDMA Modulation Profile, page 6](#)
- [Creating a Mixed Mode Modulation Profile, page 7](#)
- [Creating an A-TDMA Modulation Profile, page 9](#)
- [Configuring the DOCSIS Mode and Profile on an Upstream, page 11](#)

Creating a TDMA Modulation Profile

This section describes how to create a modulation profile for the DOCSIS 1.0/DOCSIS 1.1 TDMA mode of operation, using one of the preconfigured modulation profiles.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable modulation-profile** *profile* {**mix** | **qam-16** | **qpsk** | **robust-mix**}
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable Router#	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal Router(config)#	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<pre>cable modulation-profile profile {mix qam-16 qpsk robust-mix}</pre> <p>Example:</p> <pre>Router(config)# cable modulation-profile 3 mix Router(config)# cable modulation-profile 4 qpsk</pre>	<p>Creates a preconfigured modulation profile, where the burst parameters are set to their default values for each burst type:</p> <ul style="list-style-type: none"> • <i>profile</i> = Specifies the modulation profile number. For the DOCSIS 1.0/DOCSIS 1.1 TDMA mode, the valid range is 1 to 10, 21 to 30, or 41 to 50, depending on the cable interface being used. The system creates profile 1, 21, or 41 as a default TDMA-only modulation profile. • The following preconfigured profiles are available: <ul style="list-style-type: none"> – mix = Default QPSK/16-QAM profile. – qam-16 = Default 16-QAM profile. – qpsk = Default QPSK profile. – robust-mix = Default QPSK/16-QAM profile that is more robust and more able to deal with noise than the mix profile.
	<p>Note You can also create custom modulation profiles with the cable modulation-profile command by configuring the values for the individual burst parameters. These parameters, however, should not be modified unless you are thoroughly familiar with how changing each parameter affects the DOCSIS MAC layer. We recommend using the preconfigured default modulation profiles for most cable plants.</p>	
Step 4	<pre>exit</pre> <p>Example:</p> <pre>Router(config)# exit Router#</pre>	<p>Exits global configuration mode.</p>

Creating a Mixed Mode Modulation Profile

This section describes how to create a modulation profile for the mixed TDMA/A-TDMA mode of operation, using one of the preconfigured modulation profiles.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable modulation-profile profile {mix-high | mix-low | mix-mid | mix-qam | qam-16 | qpsk | robust-mix-high | robust-mix-mid | robust-mix-qam}**
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>enable</p> <p>Example: Router> enable Router#</p>	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	<p>configure terminal</p> <p>Example: Router# configure terminal Router(config)#</p>	Enters global configuration mode.
Step 3	<p>cable modulation-profile <i>profile</i> {mix-high mix-low mix-mid mix-qam qam-16 qpsk robust-mix-high robust-mix-mid robust-mix-qam}</p> <p>Example: Router(config)# cable modulation-profile 143 mix-medium Router(config)# cable modulation-profile 144 mix-high</p>	<p>Creates a preconfigured modulation profile, where the burst parameters are set to their default values for each burst type:</p> <ul style="list-style-type: none"> <i>profile</i> = Specifies the modulation profile number. For the DOCSIS 1.x and DOCSIS 2.0 mixed mode on the Cisco uBR-MC5X20S/U card, the valid range is 121 to 130. On the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X, the valid range is 141 to 150. The system creates profile 121 or 141 as a default mixed mode modulation profile (depending on the cable interface being used). The following preconfigured profiles are available: <ul style="list-style-type: none"> mix-high and robust-mix-high = Default QPSK/64-QAM profile. mix-low = Default QPSK/16-QAM profile. mix-mid and robust-mix-mid = Default QPSK/32-QAM profile. mix-qam and robust-mix-qam = Default 16-QAM/64-QAM profile. qam-16 = Default 16-QAM modulation profile. qpsk = Default QPSK modulation profile. <p>Note The robust-mix profiles are similar to but more robust than the mix profiles, so that they more able to detail with noise on the upstream.</p>
	<p>Note You can also create custom modulation profiles with the cable modulation-profile command by configuring the values for the individual burst parameters. These parameters, however, should not be modified unless you are thoroughly familiar with how changing each parameter affects the DOCSIS MAC layer. We recommend using the preconfigured default modulation profiles for most cable plants.</p>	
Step 4	<p>exit</p> <p>Example: Router(config)# exit Router#</p>	Exits global configuration mode.

Creating an A-TDMA Modulation Profile

This section describes how to create a modulation profile for the DOCSIS 2.0 A-TDMA mode of operation, using one of the preconfigured modulation profiles.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable modulation-profile** *profile* {**mix-high** | **mix-low** | **mix-mid** | **mix-qam** | **qam-8** | **qam-16** | **qam-32** | **qam-64** | **qpsk** | **robust-mix-high** | **robust-mix-low** | **robust-mix-mid**}
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable Router#	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal Router(config)#	Enters global configuration mode.

Command or Action	Purpose
<p>Step 3</p> <pre>cable modulation-profile profile {mix-high mix-low mix-mid mix-qam qam-8 qam-16 qam-32 qam-64 qpsk robust-mix-high robust-mix-low robust-mix-mid}</pre> <p>Example: Router(config)# cable modulation-profile 242 qam-32 Router(config)# cable modulation-profile 243 qam-64</p>	<p>Creates a preconfigured modulation profile, where the burst parameters are set to their default values for each burst type:</p> <ul style="list-style-type: none"> <i>profile</i> = Specifies the modulation profile number. For the DOCSIS 2.0 A-TDMA-only mode on the Cisco uBR-MC5X20S, the valid range is 221 to 230. On the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X, the valid range is 241 to 250. The system creates profile 221 or 241 as a default mixed mode modulation profile (depending on the cable interface being used). The following preconfigured profiles are available: <ul style="list-style-type: none"> mix-high and robust-mix-high = Default QPSK/64-QAM profile. mix-low and robust-mix-low = Default QPSK/16-QAM profile. mix-mid and robust-mix-mid = Default QPSK/32-QAM profile. mix-qam = Default 16-QAM/64-QAM profile. qam-8 = Default 8-QAM profile. qam-16 = Default 16-QAM profile. qam-32 = Default 32-QAM profile. qam-64 = Default 64-QAM profile. qpsk = Default QPSK modulation profile. <p>Note The robust-mix profiles are similar to but more robust than the mix profiles, so that they more able to detail with noise on the upstream.</p>
<p>Note You can also create custom modulation profiles with the cable modulation-profile command by configuring the values for the individual burst parameters. These parameters, however, should not be modified unless you are thoroughly familiar with how changing each parameter affects the DOCSIS MAC layer. We recommend using the preconfigured default modulation profiles for most cable plants.</p>	
<p>Step 4</p> <pre>exit</pre> <p>Example: Router(config)# exit Router#</p>	<p>Exits global configuration mode.</p>

Configuring the DOCSIS Mode and Profile on an Upstream

This section describes how to configure an upstream for a DOCSIS mode of operation, and then to assign a particular modulation profile to that upstream.



Note

By default, all upstreams are configured for DOCSIS 1.0/DOCSIS 1.1 TDMA-only mode, using the default modulation profile of 1.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface cable** *x/y/z*
4. **cable upstream** *n* **docsis-mode** { *atdma* | *tdma* | *tdma-atdma* }
5. **cable upstream** *n* **modulation-profile** *profile* [*profile2*]
6. **exit**
7. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable Router#	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal Router(config)#	Enters global configuration mode.
Step 3	interface cable <i>x/y/z</i> Example: Router(config)# interface cable c5/1/1 Router(config-if)#	Enters interface configuration mode for the indicated cable downstream interface.

Command or Action	Purpose
<p>Step 4</p> <pre>cable upstream <i>n</i> docsis-mode {<i>atdma</i> <i>tdma</i> <i>tdma-atdma</i>}</pre> <p>Example: Router(config-if)# cable upstream 0 docsis-mode atdma Router(config-if)# cable upstream 1 docsis-mode tdma-atdma Router(config-if)#</p>	<p>Configures the upstream for the desired DOCSIS mode of operation:</p> <ul style="list-style-type: none"> <i>n</i> = Specifies the upstream port. Valid values start with 0 for the first upstream port on the cable interface line card. atdma = Configures the upstream for DOCSIS 2.0 A-TDMA modulation profiles only. tdma = Configures the upstream for DOCSIS 1.X TDMA modulation profiles only (default). tdma-atdma = Configures the upstream for both A-TDMA and TDMA operation (mixed mode).
<p>Step 5</p> <pre>cable upstream <i>n</i> modulation-profile <i>profile</i> [<i>profile2</i>]</pre> <p>Example: Router(config-if)# cable upstream 0 modulation-profile 241 Router(config-if)# cable upstream 1 modulation-profile 131</p>	<p>Assigns the particular modulation profile to this upstream.</p> <ul style="list-style-type: none"> <i>n</i> = Specifies the upstream port. Valid values start with 0 for the first upstream port on the cable interface line card. <i>profile</i> = Specifies the modulation profile to be used on this upstream. The valid range for the <i>profile</i> parameter depends on the current DOCSIS mode: <ul style="list-style-type: none"> If the upstream is configured for DOCSIS 1.0 and DOCSIS 1.1 mode, the valid range is 21 to 30 for the Cisco uBR-MC5X20S, and 41 to 50 for the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X. The valid range is 1 to 10 for all other cards. If the upstream is configured for DOCSIS 1.X and DOCSIS 2.0 mixed mode, the valid range is 121 to 130 for the Cisco uBR-MC5X20S, and 141 to 150 for the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X. If the upstream is configured for DOCSIS 2.0 A-TDMA mode, the valid range is 221 to 230 for the Cisco uBR-MC5X20S, and 241 to 250 for the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X. <i>profile2</i> = (Optional) Specifies the number of a secondary modulation profile that the interface uses when noise on the upstream increases to the point that the primary modulation profile can no longer be used. (The secondary profile should specify a more robust profile, in terms of coping with noise, than the primary profile.) <p>Note The type of modulation profiles must match the DOCSIS mode configured for the upstream, using the cable upstream docsis-mode command.</p>
<p>Note Repeat Step 3 through Step 5 for each cable interface and upstream to be configured.</p>	

	Command or Action	Purpose
Step 6	exit Example: Router(config-if)# exit Router(config)#	Exits interface configuration mode.
Step 7	exit Example: Router(config)# exit Router#	Exits global configuration mode.

How to Monitor the A-TDMA Service Feature

To monitor the A-TDMA Service feature, use the following procedures:

- [Displaying Modulation Profiles, page 13](#)
- [Displaying Cable Modem Capabilities and Provisioning, page 14](#)

Displaying Modulation Profiles

To display the modulation profiles that are currently defined on the CMTS, use the **show cable modulation-profile** command without any options:

```
Router# show cable modulation-profile
```

Mod	IUC	Type	Preamb length	Diff enco	FEC T	FEC k	Scrambl seed	Max B size	Guard time	Last CW	Scrambl short	Preamb offset
21	request	qpsk	64	no	0x0	0x10	0x152	0	8	no	yes	0
21	initial	qpsk	128	no	0x5	0x22	0x152	0	48	no	yes	0
21	station	qpsk	128	no	0x5	0x22	0x152	0	48	no	yes	0
21	short	qpsk	72	no	0x5	0x4B	0x152	6	8	yes	yes	0
21	long	qpsk	80	no	0x8	0xDC	0x152	0	8	yes	yes	0
121	request	qpsk	64	no	0x0	0x10	0x152	0	8	no	yes	0
121	initial	qpsk	128	no	0x5	0x22	0x152	0	48	no	yes	0
121	station	qpsk	128	no	0x5	0x22	0x152	0	48	no	yes	0
121	short	qpsk	72	no	0x5	0x4B	0x152	6	8	yes	yes	0
121	long	qpsk	80	no	0x8	0xDC	0x152	0	8	yes	yes	0
121	a-short	64qam	128	no	0x5	0x63	0x152	10	8	yes	yes	0
121	a-long	64qam	128	no	0xF	0xC8	0x152	0	8	yes	yes	0
221	request	qpsk	64	no	0x0	0x10	0x152	0	8	no	yes	0
221	initial	qpsk	128	no	0x5	0x22	0x152	0	48	no	yes	0
221	station	qpsk	128	no	0x5	0x22	0x152	0	48	no	yes	0
221	short	qpsk	72	no	0x5	0x4B	0x152	6	8	yes	yes	0
221	long	qpsk	80	no	0x8	0xDC	0x152	0	8	yes	yes	0
221	a-short	64qam	128	no	0x5	0x63	0x152	10	8	yes	yes	0
221	a-long	64qam	128	no	0xF	0xC8	0x152	0	8	yes	yes	0

```
Router#
```

To display a specific modulation profile in detail, specify the profile number with the **show cable modulation-profile** command:

```
Router# show cable modulation-profile 221
```

Mod	IUC	Type	Pre len	Diff enco	FEC T	FEC k	Scrmb seed	Max B	Guard time	Last CW	Scrmb short	Pre offst	Pre Type	RS
					BYTE	BYTE	siz	size						
221	request	qpsk	68	no	0x0	0x10	0x152	0	8	no	yes	0	qpsk0	no
221	initial	qpsk	2	no	0x0	0x10	0x0	0	0	no	no	0	qpsk1	no
221	station	qpsk	128	no	0x5	0x22	0x152	0	48	no	yes	0	qpsk0	no
221	a-short	32qam	160	no	0x9	0x4C	0x152	6	8	yes	yes	0	qpsk1	no
221	a-long	64qam	132	no	0xC	0xE7	0x152	0	8	yes	yes	0	qpsk1	no
221	a-ugs	16qam	80	no	0x3	0xE7	0x152	0	8	yes	yes	0	qpsk1	no

```
Router#
```

Displaying Cable Modem Capabilities and Provisioning

To display the capabilities of the online cable modems and how the modems were provisioned, use the **show cable modem mac** command:

```
Router# show cable modem mac
```

MAC Address	MAC State	Prim Sid	Ver	Prov	Frag	Concat	PHS	Priv	DS	US	
										Saids	Sids
0007.0e03.69a1	online	2	DOC1.1	DOC1.1	yes	yes	yes	BPI+	0	4	
0007.0e03.6a05	online	3	DOC1.1	DOC1.1	yes	yes	yes	BPI+	0	4	
0007.0e03.6981	online	4	DOC1.1	DOC1.1	yes	yes	yes	BPI+	0	4	
0007.0e03.69e9	online	2	DOC1.1	DOC1.1	yes	yes	yes	BPI+	0	4	
0090.963e.d312	online(pt)	4	DOC1.1	DOC1.0	no	yes	yes	BPI	8	4	
0008.0e06.7a90	online(pt)	56	DOC1.0	DOC1.0	no	yes	no	BPI	0	0	
0002.8a0e.a392	online(pt)	57	DOC1.0	DOC1.0	no	no	no	BPI	0	0	
0000.39e8.9a4e	online(pt)	58	DOC1.0	DOC1.0	no	yes	no	BPI	0	0	
0000.39ac.4e57	online	151	DOC2.0	DOC1.0	no	yes	no	BPI	0	0	
0090.963e.d314	online(pt)	152	DOC1.1	DOC1.0	no	yes	yes	BPI	8	4	
0008.0e06.7ab8	online(pt)	153	DOC2.0	DOC1.0	no	yes	no	BPI	0	0	
0007.0e03.6cf5	online(pt)	154	DOC1.0	DOC1.0	no	yes	no	BPI	0	0	
0007.0e03.69f1	online	155	DOC1.1	DOC1.0	no	yes	yes	BPI+	0	4	
0007.0e03.6855	online	156	DOC1.1	DOC1.0	no	yes	yes	BPI+	0	4	
0007.0e03.6ca1	online	157	DOC1.1	DOC1.0	no	yes	yes	BPI+	0	4	
0050.daf8.0296	online(pt)	158	DOC1.0	DOC1.0	no	no	no	BPI	0	0	
0002.8a0e.a38c	online(pt)	159	DOC2.0	DOC2.0	no	no	no	BPI	0	0	

```
Router#
```

To display how many cable modems of each DOCSIS type are online each upstream, use the **show cable modem mac summary** command:

```
Router# show cable modem mac summary
```

```

Cable Modem Summary
-----

```

Interface	Total	Mac Version			Provision Mode			
		DOC2.0	DOC1.1	DOC1.0	Reg/Online	DOC 2.0	DOC1.1	DOC1.0
Cable3/0/U1	1	0	1	0	1	0	1	0
Cable3/0/U2	1	0	1	0	1	0	1	0
Cable3/0/U3	1	0	1	0	1	0	1	0
Cable3/1/U0	1	0	1	0	1	0	0	1
Cable3/1/U1	1	0	0	1	1	0	0	1
Cable3/1/U2	3	0	1	2	3	0	1	2
Cable6/0/U1	9	1	5	3	9	1	0	8
Cable6/0/U2	1	0	1	0	1	0	0	1

```
Cable6/0/U2      2      2      0      0      2      2      0      0
Router#
```

Configuration Examples for A-TDMA Service

This section lists the following sample configurations for the A-TDMA Service feature on a Cisco CMTS router:

- [Creating Modulation Profiles Examples, page 15](#)
- [Assigning Modulation Profiles to Upstreams Examples, page 17](#)

Creating Modulation Profiles Examples

This section lists sample configurations for creating the following types of upstream modulation profiles:

- [DOCSIS 1.0/DOCSIS 1.1 TDMA Modulation Profiles, page 15](#)
- [Mixed TDMA/A-TDMA Modulation Profiles, page 16](#)
- [DOCSIS 2.0 A-TDMA Modulation Profiles, page 16](#)

DOCSIS 1.0/DOCSIS 1.1 TDMA Modulation Profiles

The following sample configurations show typical modulation profiles for the DOCSIS 1.0/DOCSIS 1.1 TDMA mode of operation when using the Cisco uBR-MC5X20S/U cable interface line card:

- Profile 1 is the default profile for TDMA operations that is automatically created on the router for legacy cable interface line cards.
- Profile 21 is the default profile for TDMA operations that is automatically created on the router for the Cisco uBR-MC5X20S/U card.
- Profiles 24 and 25 use the preconfigured 16-QAM and QPSK modulation profiles.
- Profile 26 is a typical QPSK modulation profile using some customized burst parameters.

```
cable modulation-profile 1 request 0 16 0 8 qpsk scrambler 152 no-diff 64 fixed uw8
cable modulation-profile 1 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 1 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 1 short 4 76 12 8 qpsk scrambler 152 no-diff 72 shortened uw8
cable modulation-profile 1 long 9 236 0 8 qpsk scrambler 152 no-diff 80 shortened uw8
```

```
cable modulation-profile 24 qam-16
cable modulation-profile 25 qpsk
```

```
cable modulation-profile 26 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed
cable modulation-profile 26 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 26 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 26 short 4 76 12 8 qpsk scrambler 152 no-diff 80 shortened
cable modulation-profile 26 long 8 236 0 8 qpsk scrambler 152 no-diff 80 shortened
```

Mixed TDMA/A-TDMA Modulation Profiles

The following sample configurations show typical modulation profiles for the DOCSIS 1.X/DOCSIS 2.0 mixed TDMA/A-TDMA mode of operation:

- Profile 121 is the default profile for mixed mode operations that is automatically created on the router for the Cisco uBR-MC5X20S/U card.
- Profiles 122 through 126 use the preconfigured mixed mode modulation profiles.
- Profile 127 is a typical mixed mode modulation profile some customized burst parameters.

```

cable modulation-profile 121 request 0 16 0 8 qpsk scrambler 152 no-diff 64 fixed uw8
cable modulation-profile 121 initial 5 34 0 48 qpsk scrambler 152 no-diff 32 fixed uw16
cable modulation-profile 121 station 5 34 0 48 qpsk scrambler 152 no-diff 32 fixed uw16
cable modulation-profile 121 short 5 75 6 8 qpsk scrambler 152 no-diff 72 shortened uw8
cable modulation-profile 121 long 8 220 0 8 qpsk scrambler 152 no-diff 80 shortened uw8
cable modulation-profile 121 a-short qpsk0 0 18 5 99 10 8 64qam scrambler 152 no-diff 128
shortened uw8
cable modulation-profile 121 a-long qpsk0 0 18 15 200 0 8 64qam scrambler 152 no-diff 128
shortened uw8

cable modulation-profile 122 mix-high
cable modulation-profile 123 mix-low
cable modulation-profile 124 mix-medium
cable modulation-profile 125 qam-16
cable modulation-profile 126 qpsk

cable modulation-profile 127 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed
cable modulation-profile 127 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 127 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 127 short 6 76 7 8 16qam scrambler 152 no-diff 160 shortened
cable modulation-profile 127 long 8 231 0 8 16qam scrambler 152 no-diff 160 shortened
cable modulation-profile 127 a-short 9 76 6 8 32qam scrambler 152 no-diff 160 shortened
qpsk1 1 2048
cable modulation-profile 127 a-long 12 231 0 8 64qam scrambler 152 no-diff 132 shortened
qpsk1 1 2048

```

DOCSIS 2.0 A-TDMA Modulation Profiles

The following sample configurations show typical modulation profiles for the DOCSIS 1.X/DOCSIS 2.0 mixed TDMA/A-TDMA mode of operation:

- Profile 221 is the default profile for A-TDMA mode operations that is automatically created on the router.
- Profiles 222 through 226 use the preconfigured A-TDMA mode modulation profiles.
- Profile 227 is a typical A-TDMA mode modulation profile customized burst parameters.

```

cable modulation-profile 221 request qpsk0 0 0 0 16 0 8 qpsk scrambler 152 no-diff 64
fixed uw8
cable modulation-profile 221 initial qpsk0 0 0 5 34 0 48 qpsk scrambler 152 no-diff 32
fixed uw16
cable modulation-profile 221 station qpsk0 0 0 5 34 0 48 qpsk scrambler 152 no-diff 32
fixed uw16
cable modulation-profile 221 short qpsk0 0 0 5 75 6 8 qpsk scrambler 152 no-diff 72
shortened uw8
cable modulation-profile 221 long qpsk0 0 0 8 220 0 8 qpsk scrambler 152 no-diff 80
shortened uw8
cable modulation-profile 221 a-short qpsk0 0 18 5 99 10 8 64qam scrambler 152 no-diff 128
shortened uw8
cable modulation-profile 221 a-long qpsk0 0 18 15 200 0 8 64qam scrambler 152 no-diff 128
shortened uw8

```

```

cable modulation-profile 222 qam-8
cable modulation-profile 223 qam-16
cable modulation-profile 224 qam-32
cable modulation-profile 225 qam-64
cable modulation-profile 226 qpsk

cable modulation-profile 227 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed qpsk0 1
2048
cable modulation-profile 227 initial 0 16 0 0 qpsk no-scrambler no-diff 2 fixed qpsk1 0 18
cable modulation-profile 227 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed qpsk0
1 2048
cable modulation-profile 227 a-short 9 76 6 8 32qam scrambler 152 no-diff 160 shortened
qpsk1 1 2048
cable modulation-profile 227 a-long 12 231 0 8 64qam scrambler 152 no-diff 132 shortened
qpsk1 1 2048
cable modulation-profile 227 a-ugs 3 231 0 8 16qam scrambler 152 no-diff 80 shortened
qpsk1 1 2048

```

Assigning Modulation Profiles to Upstreams Examples

This section lists sample configurations for assigning the following types of modulation profiles to upstreams:

- [Assigning DOCSIS 1.0/DOCSIS 1.1 TDMA Modulation Profiles, page 17](#)
- [Assigning Mixed TDMA/A-TDMA Modulation Profiles, page 18](#)
- [Assigning DOCSIS 2.0 A-TDMA Modulation Profiles, page 19](#)

Assigning DOCSIS 1.0/DOCSIS 1.1 TDMA Modulation Profiles

The following sample configuration shows DOCSIS 1.0/DOCSIS 1.1 TDMA modulation profiles being assigned to the upstreams on two cable interfaces on the Cisco uBR-MC5X20S/U cable interface line card. The default TDMA modulation profile (profile 21) is assigned to the upstreams on cable interface 5/1/0, and modulation profile 22 is assigned to the upstreams on cable interface 5/1/1.



Note

The **cable upstream docsis-mode tdma** command is the default configuration for upstreams, so this command is not shown in these sample configurations.

```

interface Cable5/1/0
 ip address 22.0.0.1 255.0.0.0
 ip helper-address 10.10.0.4
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave-depth 32
 cable downstream channel-id 2
 cable upstream 0 frequency 30000000
 cable upstream 0 power-level 0
 cable upstream 0 channel-width 1600000
 cable upstream 0 minislot-size 4
 cable upstream 0 modulation-profile 21
 no cable upstream 0 shutdown
 cable upstream 1 channel-width 1600000
 cable upstream 1 minislot-size 4
 cable upstream 1 modulation-profile 21
 cable upstream 1 shutdown
 cable upstream 2 channel-width 1600000

```

```

cable upstream 2 minislots-size 4
cable upstream 2 modulation-profile 21
cable upstream 2 shutdown
cable upstream 3 channel-width 1600000
cable upstream 3 minislots-size 4
cable upstream 3 modulation-profile 21
cable upstream 3 shutdown
cable upstream 4 channel-width 1600000
cable upstream 4 minislots-size 4
cable upstream 4 modulation-profile 21
cable upstream 4 shutdown
cable upstream 5 channel-width 1600000
cable upstream 5 minislots-size 4
cable upstream 5 modulation-profile 21
cable upstream 5 shutdown
!
interface Cable5/1/1
ip address 21.0.0.1 255.0.0.0
ip helper-address 10.10.0.4
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream channel-id 2
cable upstream 0 frequency 30000000
cable upstream 0 power-level 0
cable upstream 0 channel-width 1600000 1600000
cable upstream 0 minislots-size 4
cable upstream 0 modulation-profile 22
no cable upstream 0 shutdown
cable upstream 1 channel-width 1600000 1600000
cable upstream 1 minislots-size 4
cable upstream 1 modulation-profile 22
cable upstream 1 shutdown
cable upstream 2 channel-width 1600000 1600000
cable upstream 2 minislots-size 4
cable upstream 2 modulation-profile 22
cable upstream 2 shutdown
cable upstream 3 channel-width 1600000 1600000
cable upstream 3 minislots-size 4
cable upstream 3 modulation-profile 22
cable upstream 3 shutdown

```

Assigning Mixed TDMA/A-TDMA Modulation Profiles

The following sample configuration shows mixed mode TDMA/A-TDMA modulation profiles being assigned to the upstreams on a cable interface on the Cisco uBR-MC5X20S/U cable interface line card. All upstreams are configured for mixed mode and profile 121 is assigned to them, but only the first upstream is enabled.

```

interface Cable5/1/2
ip address 21.0.0.1 255.0.0.0
ip helper-address 10.10.0.4
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream channel-id 2
cable upstream 0 frequency 30000000
cable upstream 0 docsis-mode tdma-atdma
cable upstream 0 power-level 0
cable upstream 0 channel-width 1600000 1600000
cable upstream 0 minislots-size 4
cable upstream 0 modulation-profile 121

```

```

no cable upstream 0 shutdown
cable upstream 1 docsis-mode tdma-atdma
cable upstream 1 channel-width 1600000 1600000
cable upstream 1 minislots-size 4
cable upstream 1 modulation-profile 121
cable upstream 1 shutdown
cable upstream 2 docsis-mode tdma-atdma
cable upstream 2 channel-width 1600000 1600000
cable upstream 2 minislots-size 4
cable upstream 2 modulation-profile 121
cable upstream 2 shutdown
cable upstream 3 docsis-mode tdma-atdma
cable upstream 3 channel-width 1600000 1600000
cable upstream 3 minislots-size 4
cable upstream 3 modulation-profile 121
cable upstream 3 shutdown

```

Assigning DOCSIS 2.0 A-TDMA Modulation Profiles

The following sample configuration shows DOCSIS 2.0 A-TDMA modulation profiles being assigned to the upstreams on two cable interfaces on the Cisco uBR-MC5X20S/U cable interface line card. Only the first upstream on cable interface c7/1/1 is enabled for A-TDMA mode and assigned an A-TDMA profile. The first three upstreams on cable interface c7/1/2 are enabled for A-TDMA mode, and they are using the default A-TDMA modulation profile of 221.

```

interface Cable7/1/1
 ip address 20.0.0.1 255.0.0.0
 ip helper-address 10.10.0.4
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave-depth 32
 cable downstream channel-id 1
 cable upstream 0 frequency 30000000
 cable upstream 0 docsis-mode atdma
 cable upstream 0 power-level 0
 cable upstream 0 channel-width 6400000 6400000
 cable upstream 0 minislots-size 1
 cable upstream 0 modulation-profile 221
 no cable upstream 0 shutdown
 cable upstream 1 channel-width 1600000 1600000
 cable upstream 1 minislots-size 4
 cable upstream 1 modulation-profile 41
 cable upstream 1 shutdown
 cable upstream 2 channel-width 1600000 1600000
 cable upstream 2 minislots-size 4
 cable upstream 2 modulation-profile 41
 cable upstream 2 shutdown
 cable upstream 3 channel-width 1600000 1600000
 cable upstream 3 minislots-size 4
 cable upstream 3 modulation-profile 41
 cable upstream 3 shutdown
!
interface Cable7/1/2
 ip address 71.2.1.1 255.255.255.0 secondary
 ip address 71.72.71.1 255.255.255.0
 load-interval 30
 no keepalive
 cable map-advance static
 cable downstream annex B
 cable downstream modulation 256qam
 cable downstream interleave-depth 32
 cable downstream frequency 459000000

```

```
cable downstream channel-id 2
no cable downstream rf-shutdown
cable upstream 0 frequency 30000000
cable upstream 0 docsis-mode atdma
cable upstream 0 power-level 0
no cable upstream 0 concatenation
no cable upstream 0 fragmentation
cable upstream 0 modulation-profile 221
no cable upstream 0 shutdown
cable upstream 1 frequency 5104000
cable upstream 1 docsis-mode atdma
cable upstream 1 power-level 6
cable upstream 1 channel-width 200000
cable upstream 1 minislot-size 32
cable upstream 1 modulation-profile 221
cable upstream 1 shutdown
cable upstream 2 frequency 38800000
cable upstream 2 power-level 0
cable upstream 2 channel-width 800000
cable upstream 2 minislot-size 32
cable upstream 2 modulation-profile 221
cable upstream 2 shutdown
cable upstream 3 docsis-mode atdma
cable upstream 3 frequency 14000000
cable upstream 3 power-level -6
cable upstream 3 channel-width 400000
cable upstream 3 minislot-size 32
cable upstream 3 modulation-profile 221
cable upstream 3 shutdown
```

Additional References

For additional information related to configuring the Cisco uBR10012 router for A-TDMA Service, see the following references:

Related Documents

Related Topic	Document Title
CMTS Command Reference	Cisco Broadband Cable Command Reference Guide, at the following URL: http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html
Cisco IOS Release 12.2 Command Reference	Cisco IOS Release 12.2 Configuration Guides and Command References, at the following URL: http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products_installation_and_configuration_guides_list.html http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/prod_command_reference_list.html
Configuring the Cisco uBR-MC16U/X Card	<i>Configuring the Cisco uBR-MC16U/MC16X Cable Interface Line Card</i> , at the following URL: http://www.cisco.com/en/US/docs/interfaces_modules/cable/line_cards/ubr16u_x/configuration/guide/mc16uxfm.html
Configuring the Cisco uBR-MC28U/X Card	<i>Configuring the Cisco uBR-MC28U/MC28X Cable Interface Line Card</i> , at the following URL: http://www.cisco.com/en/US/docs/interfaces_modules/cable/line_cards/ubr28u_x/configuration/guide/mc28uxfm.html
Configuring the Cisco uBR-MC5X20S Card	<i>Configuring the Cisco uBR10-MC5X20S Cable Interface Line Card</i> , at the following URL: http://www.cisco.com/en/US/docs/interfaces_modules/cable/broadband_processing_engines/ubr10_mc5x20s_u_h/feature/guide/mc5x20s.html
Configuring the Cisco uBR-MC5X20U Card	<i>Configuring the Cisco uBR10-MC5X20U Cable Interface Line Card</i> , at the following URL: http://www.cisco.com/en/US/docs/interfaces_modules/cable/broadband_processing_engines/ubr10_mc5x20s_u_h/feature/guide/mc5x20u.html

Standards

Standards ¹	Title
SP-RFIV1.1-I09-020830	Data-over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 1.1
SP-RFIV2.0-I03-021218	Data-over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 2.0
SP-OSSIV2.0-I03-021218	Data-over-Cable Service Interface Specifications Operations Support System Interface Specification, version 2.0
SP-BPI+-I09-020830	Data-over-Cable Service Interface Specifications Baseline Privacy Plus Interface Specification, version 2.0

1. Not all supported standards are listed.

MIBs

MIBs ¹	MIBs Link
<ul style="list-style-type: none"> • DOCS-BPI-PLUS-MIB • DOCS-CABLE-DEVICE-MIB (RFC 2669) • DOCS-CABLE-DEVICE-TRAP-MIB • DOCS-IF-EXT-MIB • DOCS-IF-MIB (RFC 2670) • DOCS-QOS-MIB • DOCS-SUBMGT-MIB • IGMP-STD-MIB (RFC 2933) 	<p>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</p> <p>http://www.cisco.com/go/mibs</p>

1. Not all supported MIBs are listed.

RFCs

RFCs ¹	Title
RFC 2233	DOCSIS OSSI Objects Support
RFC 2665	DOCSIS Ethernet MIB Objects Support
RFC 2669	Cable Device MIB

1. Not all supported RFCs are listed.

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/cisco/web/support/index.html

Command Reference

The following commands were added or modified to support the A-TDMA Service feature.

- **cable modulation-profile**
- **cable upstream channel-width**
- **cable upstream docsis-mode**
- **cable upstream equalization-coefficient**
- **cable upstream maintain-psd**
- **cable upstream minislot-size**
- **cable upstream modulation-profile**
- **show cable modulation-profile**
- **show interface cable mac-schedule**

In addition, the following commands have had minor enhancements or additions to support the A-TDMA Service feature:

- **show cable modem verbose**—The output now includes the additional fields for DOCSIS 2.0 operation:
 - **Phy Operating Mode**—Displays the PHY-layer modulation mode for a particular cable modem (**tdma** or **atdma**).
 - **Enable DOCSIS 2.0 Mode**—Displays the value for the Enable DOCSIS 2.0 Mode field (TLV 39), if present, in the cable modem’s DOCSIS configuration file or Registration Request message.
- **show cable modem phy**—Displays the primary SID and DOCSIS operating mode for each cable modem.
- **show controllers cable**—The output for the Cisco uBR-MC5X20S/U card includes a count of “Null Modem RateLimit Dropped Pkts,” which counts the total number of packets that were dropped because they had a service flow ID (SFID) of 0. This typically means the packets were dropped because of rate-limiting on their original service flows.

For complete and current information about these commands, see the *Cisco Broadband Cable Command Reference Guide*, at the following URL:

http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html

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